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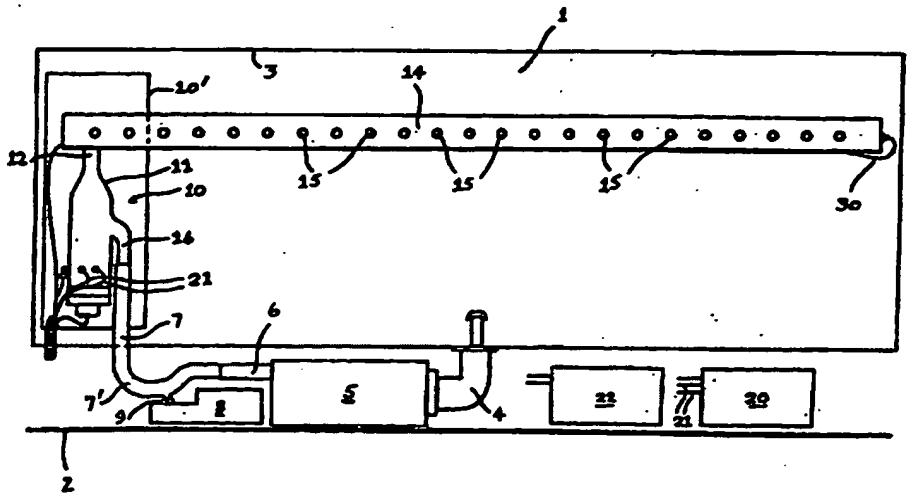
(54) Moisture supply apparatus

(57) Moisture supply apparatus comprises an airborne moisture generator (10), such as a fog generator or humidifier, connected to means (14) such as an apertured distribution tube, for delivering the so-generated airborne moisture into a refrigerated area (1), for example, a refrigerated display cabinet, wherein the airborne moisture generator (10) is connected directly to the airborne moisture delivery tube means (14).

The refrigerated display cabinet includes an outer housing (3) supported or supportable above ground level. The generator (10) is supported adjacent or at least partially within the housing (3).

The delivery means (14) and the generator (10) can be treated bacteriacidally, eg during defrosting, by means of an agent such as chlorine dioxide in aqueous solution or ozonated water, from a source (30) connected to the delivery means (14).



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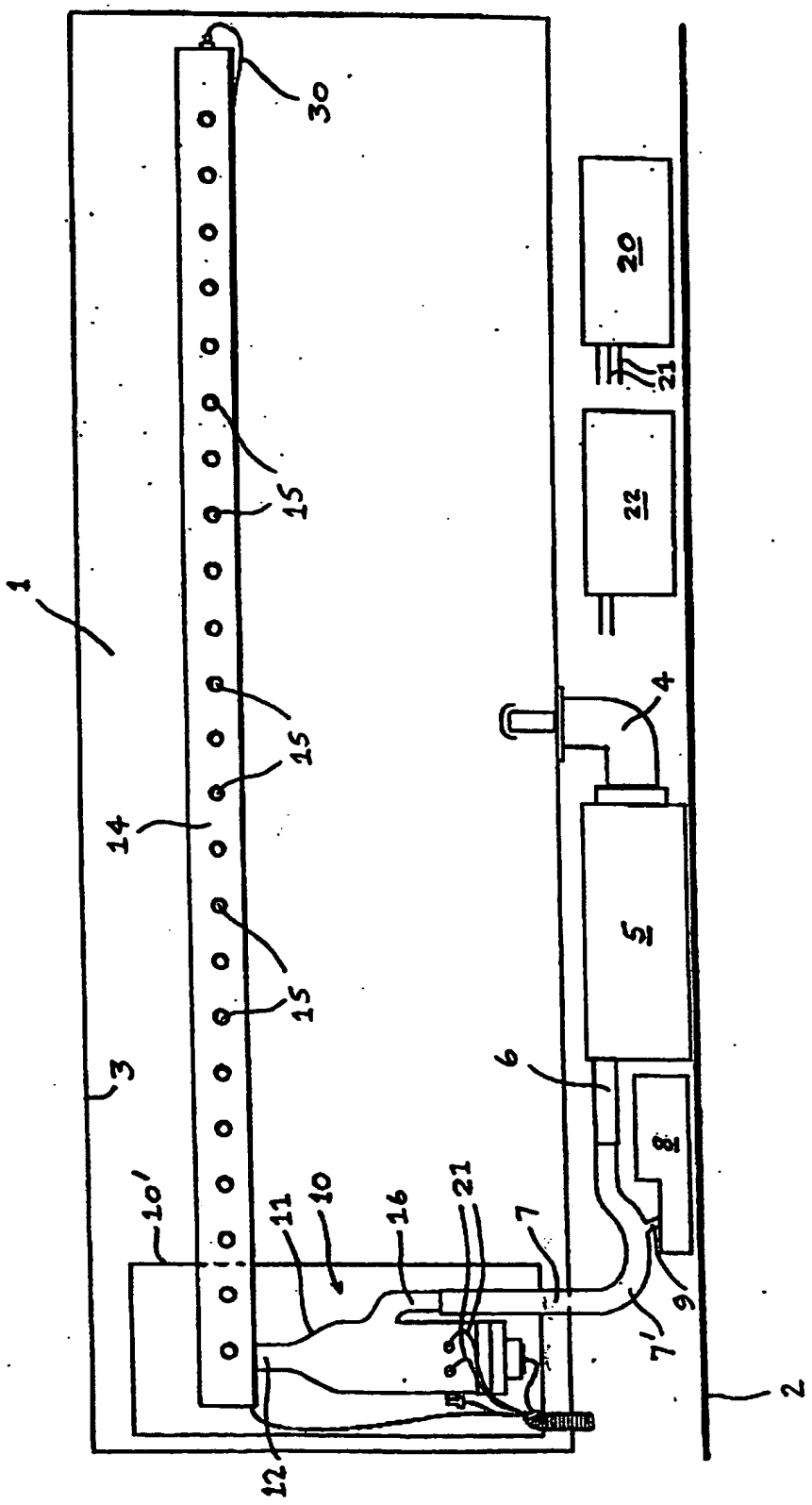
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MOISTURE SUPPLY APPARATUS

DESCRIPTION

This invention relates to moisture supply apparatus for delivering airborne moisture to the interior of, say, a refrigerated product display cabinet, a refrigerated store room or other similar refrigerated area, and of a type which is defined as comprising, inter alia, an airborne moisture generator, such as a fog generator or humidifier, connected to means, such as an apertured distribution tube, for delivering the so-generated airborne moisture into the refrigerated area.

Known apparatus of this type usually comprises a moisture generator which is located either above or beneath, say, a refrigerated product display cabinet, and is connected to airborne moisture delivery means in or adjacent the associated display cabinet by means of ducting extending between the moisture generator and the delivery means. As a consequence, the interior surface(s) of the ducting, and particularly any U-bends thereof, provides sites for bacterial growth, resulting in contamination of the airborne moisture passing through the ducting and the eventual transmission of some of the bacterial contamination into the display cabinet via the airborne moisture being delivered thereto through the apertured distribution tube or other delivery means.

It is an object of the present invention to overcome, or at least substantially reduce, the disadvantages of the known types of moisture supply apparatus discussed above.

Accordingly, a first aspect of the present invention provides moisture supply apparatus, as hereinbefore defined, wherein the moisture generator is connected directly to the means for delivering so-generated airborne moisture into an associated refrigerated area.

Preferably, the moisture generator comprises an outer watertight casing for accommodating a reservoir of water from which the airborne moisture can be generated, for example, ultrasonically, as well as other associated components, such as an ultrasonic transducer and its electrical components, in which case, at least that casing may be made of stainless steel, thereby providing a thermally-radiating heat sink for any heat generated within the moisture generator by, say, the ultrasonic transducer and/or its associated electrical components. As an alternative to stainless steel, the outer watertight casing of the moisture generator may be made of any other suitable thermally-conductive material.

In this manner, any heating of the reservoir water and/or airborne moisture generated therefrom, is reduced, and in certain cases, substantially reduced, thereby.

A second aspect of the invention resides in a method of passing airborne moisture generated by a moisture generator from the generator to means for delivering the so-generated airborne moisture into a refrigerated area, the moisture generator and the airborne moisture delivery means constituting at least part of moisture supply apparatus as defined hereinbefore, which method comprises passing the so-

generated airborne moisture from the moisture generator directly into the airborne moisture delivery means.

Thus, and in accordance with apparatus of the first aspect of the invention defined above, the moisture generator is connected directly to the airborne moisture delivery means. In practical terms, the outlet of the moisture generator may be connected directly to the inlet of the airborne moisture delivery means, for subsequent delivery to the refrigerated area, such as, the interior of a refrigerated fresh food display cabinet via the outlet(s) of the moisture delivery means, said outlet(s) preferably being in the form of a plurality of nozzles or other suitable apertures spaced along the length of a distribution tube of the delivery means.

A third aspect of the present invention resides in a moisture maintenance system comprising an at least partially enclosed refrigerated area, such as a refrigerated fresh food product display cabinet, including an outer housing supported or supportable above ground level or other support surface and a moisture supply apparatus as hereinbefore defined, wherein the airborne moisture generator, such as a fog generator or humidifier, is supported adjacent or at least partially within the housing of the at least partially enclosed refrigerated area at a level generally approximate that of the housing.

Preferably, the airborne moisture generator is located at the rear of the outer housing of the refrigerated area adjacent thereto or at least

partially therewithin.

In this manner, such location of the airborne moisture generator provides a "slimline" configuration for the moisture maintenance system, rather than locating the airborne moisture generator beneath the refrigerated area housing, as in the case of the prior art arrangement discussed above.

As in the case of the first aspect of the invention defined above, the airborne moisture generator is preferably connected directly to the airborne moisture delivery means, such as an apertured distribution tube, for delivering such moisture into the at least partially enclosed refrigerated area at least partially bounded by its associated outer housing.

In accordance with a fourth aspect of the invention, there is provided moisture supply apparatus as hereinbefore defined, which apparatus further comprises means arranged to treat bacteriacidally at least the interior of the airborne moisture delivery means and/or the interior of the airborne moisture generator.

Such bacteriacidal treating means may comprise a source of a suitable bacteriacidal agent, such as, food grade chlorine dioxide gas or solution or ozonated water, and means arranged to pass the bacteriacidal agent through the interior of the airborne moisture delivery means and/or the interior of the airborne moisture generator.

Accordingly, a fifth aspect of the invention

resides in a method of bacteriacidally treating moisture supply apparatus as hereinbefore defined, which method comprises passing a bacteriacidal agent, such as, food grade chlorine dioxide gas or solution or ozonated water, through the interior of the airborne moisture delivery means and/or the interior of the airborne moisture generator.

As in the case of the first aspect of the invention, the interiors of the airborne moisture generator and the airborne moisture delivery means may be connected directly together, in which case, the bacteriacidal agent can be passed through the interiors of both of those components of the moisture supply apparatus.

The airborne moisture delivery means and/or the airborne moisture generator may be connected to a waste sump preferably located beneath the outer housing of any at least partially enclosed refrigerated area, such as a fresh food product display cabinet, with which the moisture supply apparatus is associated, for example, that of the moisture maintenance system defined above in accordance with the third aspect of the invention.

The inventive moisture supply apparatus and/or moisture maintenance system may additionally comprise degermification means for bacteriacidally treating a supply of air fed to the airborne moisture generator and, as a consequence, any airborne moisture generated by the generator, with which that air is mixed or otherwise combined, which degermification means may also be used for bacteriacidally treating the interior surfaces of the components, such as, the airborne

moisture generator and/or the airborne moisture delivery means of the moisture supply apparatus, with, say, a bacteriacidal level of ozone.

In a preferred embodiment of the inventive moisture supply apparatus, the degermification means is connected to the input of the airborne moisture generator by suitable ducting which, in turn, may be connected to any waste sump of the moisture supply apparatus.

The presence of any waste sump provides for the disposal of not only any moisture which might condense upon the interior surfaces of the ducting between the degermification means and the airborne moisture generator and, in certain circumstances, any residual moisture which may pass upstream from the airborne moisture generator into such ducting but also any condensed moisture or water emanating from the bacteriacidal purging of the interior of the moisture delivery means and/or the interior of the airborne moisture generator during, say, defrosting of the at least partially enclosed refrigerated area of the inventive moisture maintenance system or of any refrigerated area with which the moisture supply apparatus is associated.

In order that the various aspects of the invention may be more fully understood, a preferred embodiment in accordance therewith will now be described by way of example and with reference to the accompanying diagrammatic drawing of an inventive moisture maintenance system.

Referring to the drawing, a moisture maintenance

system in accordance with the third aspect of the invention and for maintaining the moisture content and appearance of refrigerated fresh food products on display at a required level, comprises a refrigerated display cabinet 1, in which those products (not shown) are displayed and which is supported by suitable means (also not shown) above ground level 2, and a moisture supply apparatus in accordance with the first aspect of the invention. The refrigerated, fresh food product display cabinet 1 at least partially is bounded by an outer housing 3 in known manner, so that the products can be viewed at point-of-sale.

The inventive moisture supply apparatus comprises ducting 4 through which residual air from the interior of the cabinet 1 is recirculated to the apparatus, firstly into a degermification unit 5 where bacteriacidal ozone from an ozone generator (not shown) is injected, either intermittently or continuously as required, into the air passing through that unit 5. The air/ozone mixture is then passed, by means of a fan (also not shown) at or adjacent the outlet 6 of the degermification unit 5, to an ultrasonic fog generator indicated generally at 10, via ducting 7.

A pump-driven waste sump 8 communicates with the bottom of a U-bend 7' in the ducting 7, by means of a small drain pipe 9, for exhausting any residual condensed moisture (water) from the apparatus to a suitable outlet drain (not shown) in known manner.

Within the outer watertight casing 11 of the fog generator 10 is a reservoir of water from which airborne moisture is generated ultrasonically as fog

by a transducer, which fog is mixed with the air/ozone mixture passing into that casing 11 via an inlet 16 from the ducting 7. The ultrasonic transducer of the fog generator 10 is connected to an electrical power management unit indicated generally at 20 by means of suitable wiring 21.

In accordance with the first aspect of the invention, the outlet 12 of the fog generator 10 is connected directly to one end of an apertured, fog distribution tube 14 which extends over substantially the whole of the length of the display cabinet 1 at a suitable height with respect thereto and which is provided with nozzles 15 or other apparatus for delivering the fog into and evenly thereabout the interior of the cabinet 1.

Such direct connection of the fog generator 10, via its outlet 12, to the fog delivery means in the form of the distribution tube 14 eliminates any intermediate ducting therebetween which might otherwise provide surfaces for the growth of bacteria and/or any other undesirable contaminating organisms capable of being transmitted into the fog distribution tube 14 and, subsequently, into the interior of the display cabinet 1.

Also, the outer casing 11 of the fog generator 10 is made of stainless steel, or other suitable thermally conductive material, which acts as a heat sink. In this manner, heat generated within the generator 10, for example, by the ultrasonic transducer and its associated electrical components, is dissipated rapidly into the atmosphere, thereby reducing the operating temperature of the generator 10

which, in turn, attenuates the growth of bacteria and/or, indeed, any other undesirable organisms, such as mould algae and the like, within the components of the generator and within the fog generated thereby.

Further, the moisture supply apparatus comprises a management unit 22 for water being supplied to the reservoir in the casing 11 of the fog generator 10 and, also, to a means 30 for bacteriacidally treating the interiors of the fog distribution tube 14 and the fog generator 10, which means will be described in greater detail hereinbelow

It is to be noted that the degermification unit 5, the waste sump 8, the electrical management unit 20 and water management unit 22, as well as any associated ducting, are located below the display cabinet 1, whereas the fog generator 10 is at a level which is generally approximate that of the cabinet 1. In this particular embodiment, the fog generator 10 is located within a metal enclosure 10' at the rear of the cabinet housing 3, thus providing a "slimline" configuration for the moisture maintenance system of the invention.

As indicated above, the interiors of the fog distribution tube 14 and the fog generator 10 can be treated bacteriacidally, for example, when the refrigerated display cabinet is being defrosted, by means of a bacteriacidal agent, such as, food grade chlorine dioxide in aqueous solution or ozonated water, from a source 30 thereof. The source 30 is connected to one (right hand) end of the fog distribution tube 14, such that during such bacteriacidal treatment (flushing or purging in a

sterilising manner) the bacteriacidal agent is passed along the length of the tube 14 and then directly down into the casing 11 of the fog generator 10. Subsequently, the bacteriacidal agent flows out of the fog generator 10 via the inlet 16 thereof and down the ducting 7 and into the waste sump 8, via the U-bend 7' and drain pipe 9, for subsequent disposal.

Thus, and in accordance with the first and second aspects of the invention, fog (airborne moisture) of the moisture supply apparatus of the embodiment of moisture maintenance system described herein, is passed directly from the fog generator 10 into the fog distribution tube 14 (airborne moisture delivering means), whilst, in accordance with the fourth and fifth aspects of the invention, means are provided for bacteriacidally treating (sterilising) the interiors of at least the airborne moisture delivery means (fog distribution tube 14) and the fog (airborne moisture) generator 10 of the moisture supply apparatus. Additionally, the waste sump 8 is provided for the removal of the used bacteriacidal agent, such as food grade chlorine dioxide or ozonated water, from the so-treated components of the inventive moisture supply apparatus.

Moreover, because the waste sump 8 is connected via the drain pipe 9 to the ducting 7, 7' between the degermification unit 5 and the fog generator 10, that ducting, as well as the sump, can be bacteriacidally treated by both the ozone from the unit 5 and also any bacteriacidal agent, such as food grade chlorine dioxide gas or solution or ozonated water, originating from the source 30 and overflowing from the fog generator 10 via its inlet 16 during bacteriacidal

treatment of the interiors of the fog distribution tube 14 and fog generator 10.

Instead of purging, sterilising or otherwise flushing (treating) the interiors of the fog distribution tube 14 and fog generator 10 with bacteriacidal agent, such as chlorine dioxide gas or solution or ozonated water, such flushing can be carried out with water from, say, the source 30, so as to cool the fog generator 10 and also replenish its reservoir with water, to keep that water fresh and to prevent it from becoming stale and/or warm. Alternatively, that flushing procedure can be carried out using dry ozone gas for a predeterined time period, with the moisture supply apparatus switched of.

Further, the electrical power management unit 20 may be located in any suitable position other than beneath the display cabinet 1, to provide access for an operator. For example, that management unit 20 could be located adjacent the fog generator enclosure 10'.

CLAIMS

1. Moisture supply apparatus, as hereinbefore defined, wherein the airborne moisture generator is connected directly to the means for delivering so-generated airborne moisture into an associated refrigerated area.

2. Apparatus according to claim 1, wherein the airborne moisture generator comprises an outer watertight casing for accommodating a reservoir of water from which the airborne moisture can be generated.

3. Apparatus according to claim 2, wherein at least the casing of the airborne moisture generator is made of a thermally conductive material.

4. Apparatus according to claim 3, wherein the thermally conductive material from which the airborne moisture generator casing is made, is stainless steel.

5. Apparatus according to any preceding claim, wherein the airborne moisture outlet of the airborne moisture generator is connected directly to the inlet of the airborne moisture delivery means.

6. Apparatus according to any preceding claim further comprising means arranged to treat bacteriacidally at least the interior of the airborne moisture delivery means.

7. Apparatus according to claim 6, wherein the bacteriacidal treating means is arranged to treat the interior of the airborne moisture generator.

8. Apparatus according to claim 6 or 7, wherein the bacteriacidal treating means comprises a source of bacteriacidal agent and means arranged to pass the bacteriacidal agent through the interior of the airborne moisture delivery means and/or the interior of the airborne moisture generator, as the case may be.

9. Apparatus according to claim 8, wherein the source of bacteriacidal agent is located downstream of the airborne moisture delivery means.

10. Apparatus according to claim 8 or 9, wherein the bacteriacidal agent is food grade chlorine dioxide gas or solution or ozonated water.

11. Apparatus according to any preceding claim, wherein the airborne moisture generator and/or airborne moisture delivery means is/are connected to a waste sump.

12. Apparatus according to claim 11, wherein the waste sump is located or locatable beneath an outer housing of any at least partially enclosed refrigerated area with which the moisture supply apparatus is or can be associated.

13. Apparatus according to any preceding claim further comprising degermification means for bacteriacidally treating a supply of air fed to the airborne moisture generator and, as a consequence, any airborne moisture generated thereby with which that bacteriacidally-treated air is mixed or otherwise combined.

14. Apparatus according to claim 13, wherein said degermification means is also arranged to treat bacteriacidally the interior surfaces of the components of the apparatus.

15. Apparatus according to claim 13 or 14, wherein said degermification means is connected to the input of the airborne moisture generator by ducting.

16. Apparatus according to claim 15 when dependent upon any of claims 11 to 14, wherein the ducting is also connected to the waste sump.

17. Apparatus according to claim 13 or any of claims 14 to 16 when dependent upon claim 13, wherein said degermification means comprises a source of ozone for bacteriacidally treating the supply of air fed to the airborne moisture generator and/or the interior surfaces of at least some of the other components of the apparatus, as the case may be.

18. Moisture supply apparatus as hereinbefore defined and substantially as hereinbefore described with reference to the accompanying drawings.

19. A method of passing airborne moisture generated by an airborne moisture generator from the generator to means for delivering the so-generated airborne moisture into a refrigerated area, the airborne moisture generator and the airborne moisture delivery means constituting at least part of moisture supply apparatus as hereinbefore defined, which method comprises passing the so-generated airborne moisture from the generator directly into the airborne moisture delivery means.

20. A method of passing airborne moisture generated by an airborne moisture generator from the generator to means for delivering the so-generated airborne moisture into a refrigerated area, substantially as hereinbefore described.

21. A moisture maintenance system comprising an at least partially enclosed refrigerated area which includes an outer housing supported or supportable above ground level or other support surface, and moisture supply apparatus according to any of claims 1 to 17, wherein the airborne moisture generator is supported adjacent or at least partially within the housing of the at least partially enclosed refrigerated area at a level generally approximate that of the housing.

22. A system according to claim 21, wherein the airborne moisture generator is located at the rear of the outer housing of the at least partially enclosed refrigerated area adjacent thereto or at least partially therewithin, to provide a slimline configuration for the system.

23. A moisture maintenance system substantially as hereinbefore described with reference to the accompanying drawings.

24. Moisture supply apparatus, as hereinbefore defined, including means arranged to treat bacteriacidally at least the interior of the airborne moisture delivery means.

25. Apparatus according to claim 24, wherein the bacteriacidal treating means is arranged to treat the

interior of the airborne moisture generator.

26. Apparatus according to claim 24 or 25, wherein the bacteriacidal treating means comprises a source of bacteriacidal agent and means arranged to pass the bacteriacidal agent through the interior of the airborne moisture delivery means and/or the interior of the airborne moisture generator, as the case may be.

27. Apparatus according to claim 26, wherein the source of bacteriacidal agent is located downstream of the airborne moisture delivery means.

28. Apparatus according to claim 26 or 27, wherein the bactericidal agent is food grade chlorine dioxide gas or solution or ozonated water.

29. Apparatus according to any of claims 24 to 28, wherein the airborne moisture generator and/or airborne moisture delivery means is/are connected to a waste sump.

30. Apparatus according to claim 29, wherein the waste sump is located or locatable beneath an outer housing of any at least partially enclosed refrigerated area with which the moisture supply apparatus is or can be associated.

31. Apparatus according to claim 29 or 30, wherein the waste sump is located upstream of the airborne moisture generator.

32. Apparatus according to claim 30, wherein the waste sump is connected to ducting connecting the

airborne moisture generator to an air supply therefor upstream thereof.

The Patent Office

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Application No:	GB 9723580.8	**Examiner:**	M C Monk
Claims searched:	1-23	**Date of search:**	23 December 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): F4H (H2L); B1R (RAJA)

Int Cl (Ed.6): F24F (3/14)

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2258299 A	FRACTAL Example of a spray injector.	1,2,5-9,13-15,19 at least
X	GB 2187111 A	STULZ Consider whole document.	1,19 at least
X	GB 2119501 A	IZUMI MASAHIKO Consider whole document: Refrigerated display chamber (10).	1,19 at least
X	GB 2017285 A	LINDE See passage running from ll.37-82 p.2 at least & Fig.2.	1,19 at least
X	GB 1578269	DEFENSOR Consider outlet duct (13,22).	1,19 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

The Patent Office

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Application No:	GB 9723580.8	**Examiner:**	M C Monk
Claims searched:	24-32	**Date of search:**	23 December 1997

Patents Act 1977
Further Search Report under Section 17

Databases searched:

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Int Cl (Ed.6): F24F (3/16)

Other: ONLINE DATABASE:WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
XE	GB 2301175 A	NORMAN PENDRED Means (7) may include an ultraviolet light.	24-26
X	GB 2258299 A	FRACTAL INC See ll.18-29 p.10 re ultraviolet purifier (7).	24-26
A	GB 2249827 A	H & M DISINFECTION SYSTEMS Example of an arrangement for externally cleaning a cooling coil.	24
X	GB 2036951 A	SCHMIDT-REUTER Example of an air-cleaning system having moistening and ionising steps.	24-26
X	GB 961260	SVENSKA FLAKTFABRIKEN Example or air-conditioning apparatus having radiation lamps (11).	24-26

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.